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SOLAR OBSERVATIONS

SOLAR RADIATION MEASUREMENTS DURING DECEMBER, 1931

By HERBERT H. KIMBAL, in charge, solar radiation investigations

For a description of instruments and their exposures, the reader is referred to the January, 1931, Review, page 41.

Table 1 shows that solar radiation intensities averaged above the normal values for December at Washington

and Madison and close to normal at Lincoln.

Table 2 shows an excess in the total solar radiation received on a horizontal surface at Chicago, New York, and Miami as compared with the December normals for the respective stations; close to normal at Pittsburgh, and a deficit at Washington, Madison, Lincoln, Twin Falls, Fresno, Gainesville, and La Jolla. The last line in the table gives annual departures in percentages of annual totals.

Skylight polarization measurements made on 4 days at Washington give 61 for the mean percentage of polarization, with a maximum of 65 per cent on the 2d and 6th. At Madison, polarization measurements made on three days early in the month give a mean of 72 per cent with a maximum of 77 per cent on the 1st. These are above the corresponding averages for each station in December.

Table 1.—Solar radiation intensities during December, 1931 [Gram-calories per minute per square centimeter of normal surface] Washington, D. C.

| | | Sun's zenith distance | | | | | | | | | | |
|-------------|----------------------|-----------------------|---------|--------|------------------|---------|-------|---------|--------|-------------|---------------|--|
| Date . | 8a. m. | 78.7° | 75.7° | 70.7° | 60.0° | 0.0° | 60.0° | 70.7° | 75.7° | 78.7° | Noon | |
| | 75th mer. time | Air mass | | | | | | | | | | |
| | | | A. | M. | | | | Р. Ж. | | | solar time | |
| | | 5.0 | 4.0 | 3.0 | 2.0 | 1 1.0 | 2.0 | 3.0 | 4.0 | 5.0 | е. | |
| | mm. | cal. | cal. | cal. | cal. | cal. | cal. | cal. | cal. | cal. | mm. | |
| Dec. 2 | 2.49 | | | | | | | 1. 12 | 0.95 | | | |
| Dec. 7 | 3.15 | | 1.00 | | | | | 1.12 | | | | |
| Dec. 15 | 3. 30 | | | | 1.33 | | | 1.06 | 0.83 | 0.58 | 2.87 | |
| Dec. 16 | 3.81 | | 0.97 | 1. 13 | 1.38 | | | | | | 2.74 | |
| Dec. 23 | 8. 18 | | | | | | J | | | | 6.02 | |
| Means | | 0.87 | 0.99 | | | | | 1. 10 | | | | |
| Departures | | +0.08 | +0.03 | +V. US | +0.11 | | | +0.06 | -U, V3 | -0,06 | | |
| | | | | Madi | son, W | is. | | | | | | |
| Dec. 1 | 2. 49 | | | | 1.42 | | | | | | 1.96 | |
| Dec. 2 | 2.87 | | | 1. 23 | | | | | | | 3.00 | |
| Dec. 3 | 3. 30 | | 1.04 | | | | | | | | 3. 13 | |
| Dec. 7 | 1.37 | | !:-:: | | | | | 1.26 | | | 1. 24 | |
| Dec. 14 | 2. 36 | | | | | | | (3 00) | | | 2. 26 | |
| Means | | (1, 02) | (1, 10) | 1,21 | (1, 42) +0.07 | | | (1, 26) | | | | |
| Departures | | +0.06 | ±0.00 | ±0,00 | +0.07 | | | +0.02 | | | | |
| | · | ! | ' | Linco | in, Nei | br. | ! | 1 | | | L | |
| Dec 1 | 2.36 | 1.05 | 1. 13 | 1. 29 | | | 1 | 1. 23 | 1.09 | 0. 88 | 3. 30 | |
| Dec. 1 | 3.00 | 1.00 | 1.13 | 1. 20 | | | | 1. 23 | | | | |
| Dec. 11 | 6. 50 | | 0.99 | | | | | 1. 25 | 1.11 | | | |
| Dec. 14 | 2.26 | 0. 90 | 1.09 | | | | | 1. 23 | | | 3.00 | |
| Dec. 15 | 2.62 | 0.79 | 1.04 | | | | | 1. 21 | 1.07 | | | |
| Dec. 16 | 3, 15 | | 0.99 | | | | | 1. 15 | | | 3, 63 | |
| | J | 0.90 | 1.05 | | | | | 1.22 | | | | |
| Means | | | | | | | | | | | | |

Table 2.—Total solar radiation (direct + diffuse) received on a horizontal surface

| | | [0 | łram- | calories | per squ | are cent | timeter] | | | | | |
|---|----------------------------------|--------------------------------|-------------------------|-------------------------------|--------------------------------|----------------------------------|------------------------------|----------------------------------|----------------------------------|----------------------------------|-------------------------|----------------------------------|
| | Average daily totals | | | | | | | | | | | |
| Week, be- ginning | Washington | Madison | Lincoln | Chleago | New York | Twin Falls | Pittsburgh | Gainesville | Fresno | La Jolla | Mlami | Fairbanks |
| 1931 Dec. 3 Dec. 10 Dec. 17 Dec. 24 | cal. 156 133 118 137 | cal. 115 113 74 66 | 156 | cal. 90 112 90 64 | cal. 112 85 83 160 | cal. 103 163 118 101 | cal. 85 78 82 65 | cal. 142 187 189 204 | cal. 163 170 169 122 | cal. 220 250 188 202 | 364 | cal. 2.0 1.5 1.2 1.7 |
| | Departures from weekly normals | | | | | | | | | | | |
| Dec. 3 Dec. 10 Dec. 17 Dec. 24 | +8 -5 -22 -5 | -6 +1 -47 -58 | -55 -1 -33 -88 | +18 +40 +13 -16 | +22 -5 -12 +58 | -37 +37 -10 -51 | +5 +10 +15 -19 | | -14 +2 +8 -25 | 10 | +73 +69 +86 -4 | |
| | Departures from annual normals | | | | | | | | | | | |
| Gr. cal./ cm. ² Percentage | 1, 750 1. 4 | +1, 965 +1. 2 | 445 0.3 | +2, 938 +3. 2 | +2, 893 +3. 1 | -5, 846 -3. 9 | -1, 42 0 | | +1, 718 +1. 1 | | | |

POSITIONS AND AREAS OF SUN SPOTS

[Communicated by Capt. J. F. Hellweg, Superintendent United States Naval Observatory. Data furnished by Naval Observatory, in cooperation with Harvard, Yerkes, Perkins, and Mount Wilson observatories. The differences of longitude are measured from central meridian, positive west. The north latitudes are plus. Areas are corrected for foreshortening and are expressed in millionths of sun's visible hemisphere. The total area, including spots and groups, is given for each day in the last column]

| | Eastern standard civil time | | н | eliograp | hic | Area | | Tota area |
|---|-----------------------------------|---------------------|---|--|--|--|------------|--------------------|
| Date | | | Diff. long. | Longi- tude | Lati- tude | Spot | Group | for each day |
| 1931 Dec. 1 (Mount Wilson) Dec. 2 (Naval Observatory) | h 13 | m 50 | | 331. 5 No spot | | | 9 137 | 146 |
| Dec. 3 (Naval Observatory) Dec. 4 (Mount Wilson) Dec. 5 (Naval Observatory) Dec. 6 (Naval Observatory) | 10 12 10 10 | 33 0 35 23 | -63.0 | No spot 162. 9 No spot 124. 4 | +12.0 | 31 | 67 | 67 |
| Dec. 7 (Naval Observatory) Dec. 8 (Naval Observatory) Dec. 9 (Yerkes Observatory) | 10 12 15 | 36 47 9 | -54.0 -40.0 -28.5 -27.7 | 133. 1 132. 8 129. 9 130. 7 | +11.5 $+11.5$ $+10.4$ $+11.7$ | 5 | 170 278 | 170 278 |
| | | | -27. 7 -27. 6 -26. 1 -25. 2 -25. 1 -25. 1 | 130. 7 130. 8 132. 3 133. 2 133. 3 133. 3 | +10.6 +10.0 +10.0 +13.8 +13.0 +12.2 | 17 17 3 5 3 | 14 | |
| Dec. 10 (Naval Observatory) | 10 | 17 | -22.8 -21.6 -38.0 -14.0 | 135.6 136.8 109.8 133.8 | +12.5 +11.9 +4.0 +11.0 | 210 | 62 340 | 519 402 |
| Dec. 11 (Naval Observatory) | 11 | 20 | -23.0 -1.0 | 111.0 | +4.0 +11.0 | | 154 401 | 555 |
| Dec. 12 (Yerkes Observatory) | 14 | 18 | -1.0 -10.2 -9.7 -9.3 -6.3 -5.4 +10.5 +11.1 +11.9 +13.6 +16.6 +17.7 | 109. 1 109. 6 110. 0 113. 0 113. 9 129. 8 130. 4 131. 2 132. 9 135. 9 | +4.3 +5.3 +4.1 +4.3 +10.2 +11.0 +11.2 +11.7 +12.2 +12.4 | 7 5 2 22 88 2 2 2 | 48 | 419 |
| Dec. 13 (Mount Wilson) | 11 | 30 | +4.0 +26.0 | 111.6 | +5.0 +12.0 | | 41 298 | 339 |